Space Weather Technical Forecast

Issued on Tuesday, 29 November 2022 at 00:21 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of Minor Geomagnetic Storm (G1) intervals through the period.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Very Low in the past 24 hours, with no significant flares. There are currently three numbered sunspot regions on the visible disc. Two regions are located close to the western limb, AR3149 (Hsx/Alpha) in the northwest and AR3151 (Cai/Beta) in the southwest, with AR3151 showing some recent decay in its intermediate and trailer spots. AR3152 now centre disc in the northern hemisphere, continues as a small, simple bi-polar group.

No new Earth-directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar wind parameters, as measured by ACE and DSCOVR at L1, were indicative of positive coronal hole HSS influences and perhaps with some embedded CME finfluence. Solar wind speeds rose erratically from 500 km/s at the start of the period to between 600-650 km/s, with a peak of 684 km/s, but have dropped back to 550 km/s in the last few hours. Density was average. The interplanetary magnetic field, IMF Bt, varied between 6nT and 12nT with an overall slight downward trend. The north south component varied between +8/-10, with the largest fluctuations at the start of the period. The phi angle was predominantly positive (away from the Sun). Geomagnetic activity was initially at G1/Minor Storm (Kp 5) level 28/0000-0600 UTC , then Quiet to Unsettled (Kp 1 to 3) until 28/1800 UTC, with Active conditions to end the UTC day.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) as measured at GOES16 has remained at Background levels. High energy electron flux (greater than 2MeV) at GOES16 was at Background to Moderate levels with a peak of 265pfu at 28/1750UTC. Observed fluence at 29/0001 UTC was 4.87e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to remain Very Low over the forecast period, with a chance of isolated C-class flares, and just a very slight chance of isolated M-flares.

Solar Wind / Geomagnetic Activity: There are currently no Earth directed CMEs expected. Further coronal hole influences are expected to continue through the period. Firstly from CH49/+ in the northwest quadrant on days 1 and 2 (29 and 30 Nov). This is then likely to be followed by further enhancement from the larger trans-equatorial CH51/+ from later on day 3 (1 Dec). Solar winds are expected to be in the range slightly elevated to elevated, perhaps becoming strong at times later in the period.

Geomagnetic activity is expected to be often Unsettled, with occasional Active intervals, and a chance of isolated G1/Minor storm intervals. The chance for G1 likely to be higher later in the

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period, associated with the larger coronal hole 51/+.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) observed by GOES16 is expected to remain at Background levels throughout. High energy electron flux (greater than 2 MeV), observed by GOES16, is expected to show an overall rise over the next couple of days with a chance of reaching High levels during the diurnal maxima, due to further coronal hole HSS influences. However, confidence is low.

Fluence levels may also show an overall rising trend through the period, however the magnitude of further coronal hole influences is uncertain, and coupled with uncertain model guidance, confidence is low.

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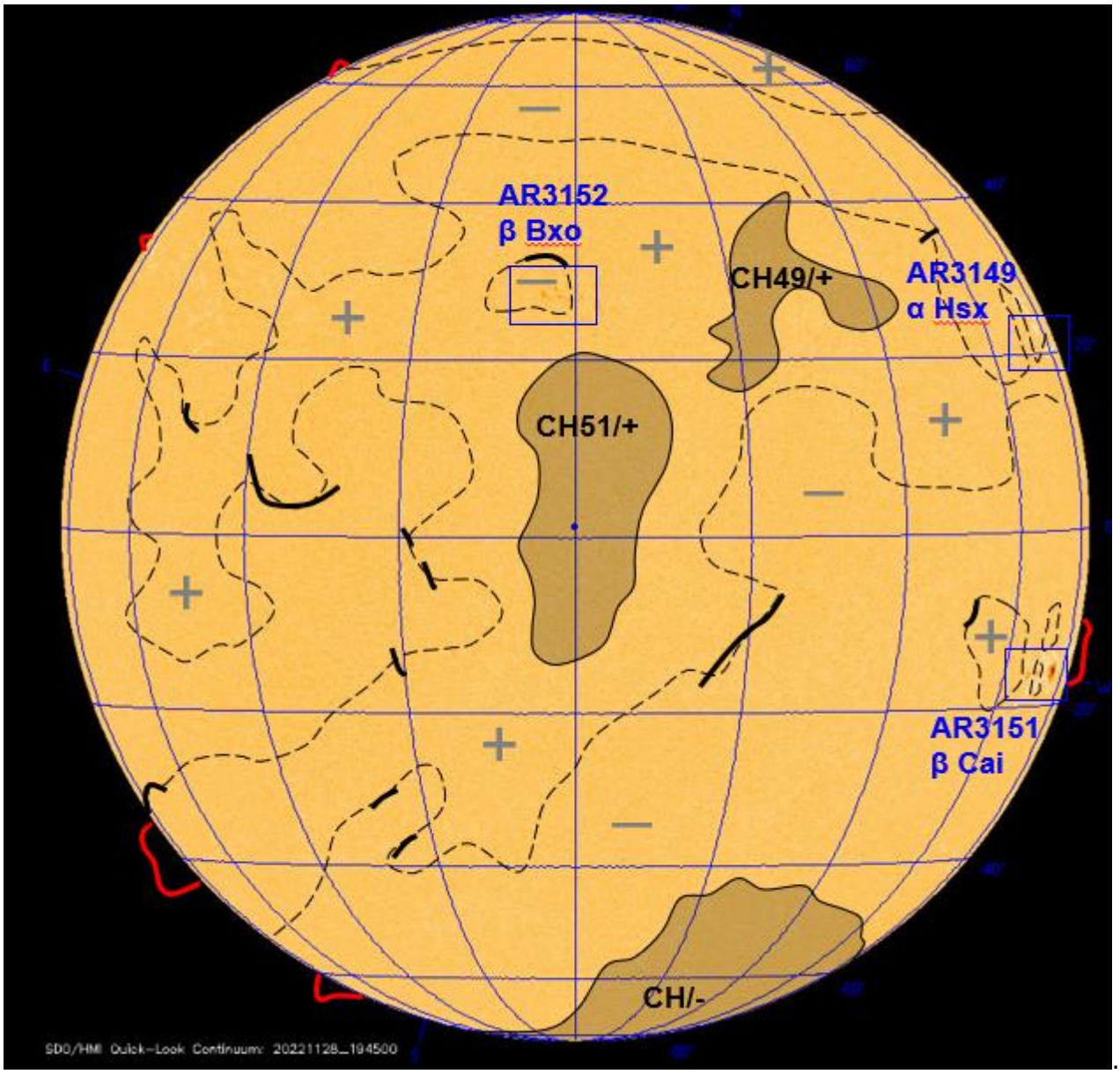
Figure 1. Solar Analysis Valid 28/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are currently no Earth directed CMEs expected.

Earth is assessed to currently be in the waning influence of a HSS from CH48/+ which has now passed beyond the western limb, with perhaps some weak glancing CME influence also mixed in over the past 24 hours, although this aspect is uncertain. Further coronal hole influences are expected to continue through the period. Firstly from CH49/+ in the northwest quadrant on days 1 and 2 (29 and 30 Nov). This is then likely to be followed by further enhancement from the larger trans-equatorial CH51/+ from later on day 3 (1 Dec). Solar winds are expected to be in the range slightly elevated to elevated, perhaps becoming strong at times later in the period.

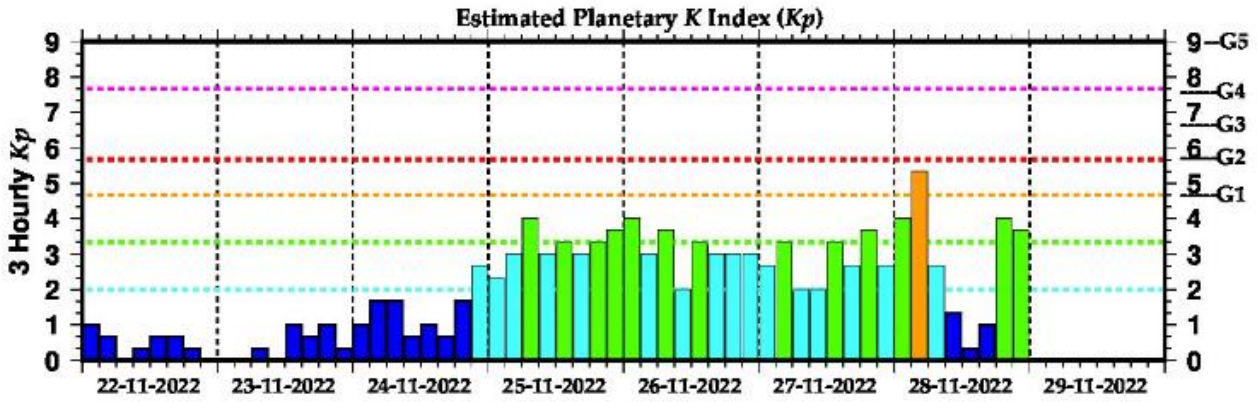
Geomagnetic activity is expected to be often Unsettled, with occasional Active intervals, and a chance of isolated G1/Minor storm intervals. The chance for G1 likely to be higher later in the period, associated with the larger coronal hole 51/+.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	30	30	40	40
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None currently expected.

Figure 2: BGS plot of planetary K (Kp)



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Met Office Space Weather Technical Forecast

Radio Blackouts - X-Ray Flares:

Solar activity is forecast to remain Very Low over the forecast period, with a chance of isolated C-class flares, and just a very slight chance of isolated M-flares.
There are currently three numbered sunspot regions on the visible disc. Two regions are located close to the western limb, AR3149 (Hsx/Alpha) in the northwest and AR3151 (Cai/Beta) in the southwest, with AR3151 showing some recent decay in its intermediate and trailer spots. AR3152 now centre disc in the northern hemisphere, continues as a small, simple bi-polar group.

STEREO-A imagery doesn't currently show any significant bright flux regions just beyond the east limb, however far-sided seismic data gives the possibility of a couple of possible active regions returning around the east limb towards the end of the period. Probabilities are being maintained until these possible active regions emerge onto the visible disc.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10MeV) at GEO, as observed by GOES16 is currently at background levels and is expected to remain at this level throughout.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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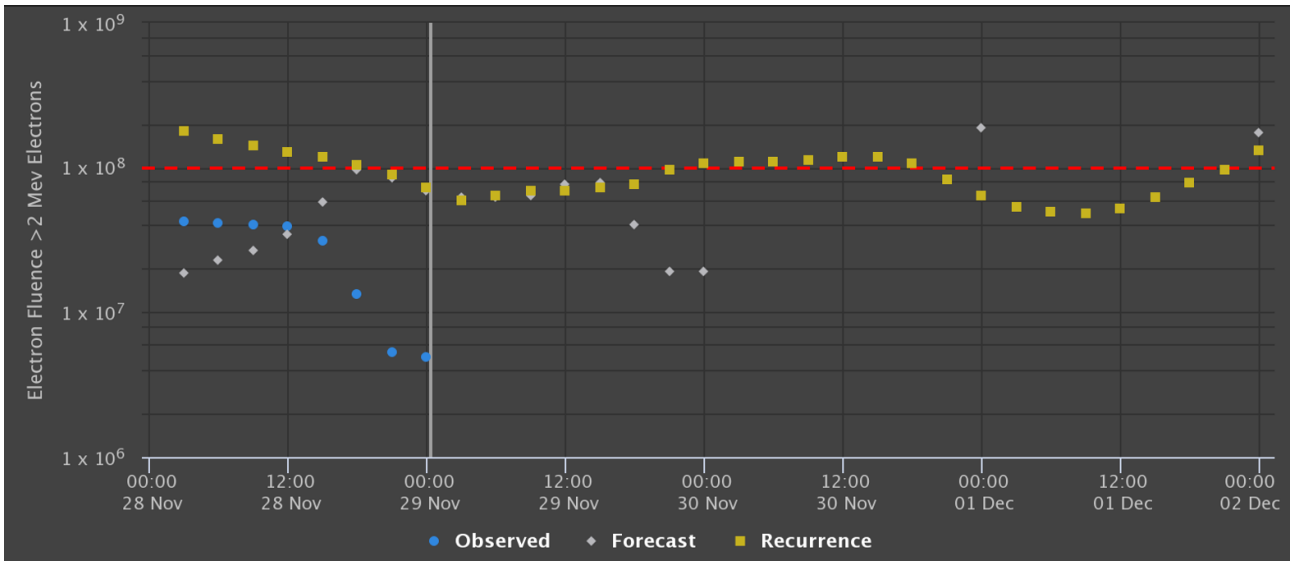
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) observed by GOES16 has been at background to moderate levels. Flux levels may increase over the next couple of days to reach High levels during the diurnal maxima. However, impacts of further coronal hole HSS influences through the period may have the impact of knocking out electrons or compressing the electron field, acting to inhibit the potential for a protracted period of High flux levels. Therefore, confidence is low.

Fluence levels have dropped sharply and are well below the 1e8 integrated electron fluence active threshold, and also well below REFM and recurrence predictions. An overall rising trend is probable through the period, however given the uncertainties mentioned regarding further coronal hole effects, coupled with uncertain model guidance, confidence is low.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	20	30	40	40
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: MOSWOC REFM latest output



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